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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/722,700	11/25/2003	Loucas Tsakalakos	139081-1	9948

41838 7590 05/02/2007

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EXAMINER	
MCCRACKEN, DANIEL	

ART UNIT	PAPER NUMBER
1754	

MAIL DATE	DELIVERY MODE
05/02/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/722,700	TSAKALAKOS ET AL.	
	Examiner	Art Unit	
	Daniel C. McCracken	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *1/29/2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *30,32-52 and 54-72* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *30,32-52 and 54-72* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

The Examiner acknowledges the contents of the interview summary, yet respectfully disagrees with the procedural posture of the application as set forth by Applicants. For purposes of clarifying the record, the following summary of the germane portions of the file wrapper is presented below:

- **April 14, 2006** – Final Action issues
- **June 16, 2006** – Applicant files *After-Final* Remarks **and** Amendments to Claims. *See e.g.* Remarks of June 16, 2006, page 7:

> In the Office Action, the Examiner rejected claims 30, 32-52, 54 and 55. By this paper, the *Applicants hereby amend* claims 30, 54 and 55 for clarification of certain features to expedite allowance of the present application. *These amendments* do not add any new matter. Upon entry of these *amendments*, claims 30, 32-52, 54 and 55 will remain pending in the present patent application and are believed to be in condition for allowance. In view of the foregoing *amendments* and the following remarks, the Applicants respectfully request reconsideration and allowance of all pending claims. (emphasis added).

Referring to the Claims filed on 06/16/2006, Applicants indeed amended the claims as they said they did in their remarks. For example on June 16, 2006, Claim 30 read as follows:

> 30. (currently amended) A field emission device, comprising
> a substrate having a top side and an opposite bottom side;
> [[an]] a conductive epitaxial buffer layer affixed to the top side of the substrate; a dielectric layer disposed on the top side;
> a conductive layer disposed on top of the dielectric layer opposite the substrate, the conductive layer and the dielectric layer defining a cavity extending downwardly to the substrate;
> and at least one nanorod affixed to the substrate via the conductive epitaxial buffer layer and substantially disposed within the cavity.

Inspection of Claims 54 and 55 show amendments as well. Clearly, Applicants made several After-Final Amendments.

- **July 10, 2006** – Advisory Action issues. The Examiner (the current Examiner's predecessor) stated on the Continuation Sheet of the Advisory Action (PTO-303): "The proposed amendment adds the Imitation of a "conductive" epitaxial buffer layer, which was not previously presented in any of claims that depended from claim 30. As such, this limitation raises new isues that would require further consideration and possibly a further search." *See* Advisory Action of 07/10/2006, p. 2 ("Continuation of 3:"). Further inspection of the Advisory Action shows that Amendments were not entered. *See* Advisory Action of 07/10/2006 (Box 7(a) was checked, indicating the proposed amendments *will not be entered*).
- **July 19, 2006** – Request for Continued Examination (RCE) Filed. The plain language of the RCE Transmittal Form informs Applicants what will be done with amendments not entered after a final action, and instructs the Office what to do. The pertinent portion of the Request for Continued Examination Transmittal is reproduced below:

1. ☐ Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
   a. ☑ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
      ii. ☐ Other _____

By checking this box, Applicants – by and through their undersigned counsel – instructed the U.S. Patent and Trademark Office to enter the previously filed amendments and examine the case on the merits. This is exactly what happened.

- **September 14, 2006** – Non-final Action after RCE issues
- **September 14, 2006** – Applicants submit Remarks and Amendments to Claims. Here, Applicants wrote 16 new claims. *See* Claims 56-72

It was at this point in the timeline where prosecution became confused. The Office had been instructed to examine Applicants claims and had done so, by virtue of the Non-Final Office Action dated September 14, 2006. Applicants apparently thought that they could enter a preliminary amendment, however this is not the case. As was stated in the Office communication dated 12/18/2006:

> The supplemental reply filed on 9/14/2006 was not entered because supplemental replies are not entered as a matter of right except as provided in 37 CFR 1.111(a)(2)(ii). Applicants RCE was not accompanied with a request to suspend for three months. See MPEP 714.03(a) ("Supplemental Amendment") and MPEP 709 ("Suspension of Action").As Applicants' new claims of 9/14/2006 were not entered or examined, any amendments or new claims the Applicants wish to add must be made in response to the Non-Final Office Action of 9/14/2006, in the time period set forth on the Office Action Summary (PTO Form 326).

Notwithstanding Applicants' attorney's numerous attempts to convince the Examiner that the postage date of the amendments to the claims is controlling, this argument does not address what Applicants' attorney told the Office to do when the RCE of July 19, 2006 was filed – namely, enter the amendments and examine the claims.

All of this rigmarole is necessary, of course, for "record keeping," so-to-speak. For purposes of moving prosecution forward, the claims will be treated as their status identifiers as filed January 29, 2007 indicated. This is the correct result for advancing prosecution. All prior arguments and remarks attacking the Office Action September 14, 2006 as "incomplete" will not be considered. From this point forward, the Examiner will consider the Claims and Remarks as filed January 29, 2007. The issue of finality is treated in the Conclusion.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The references teach or suggest each and every limitation of the rejected claims. The pinpoint citations provided are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found.

Claims 30, 35, 36, 38-40, 42-51, and 56-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum.

As to claims 30, 38, and 40, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); and carbon fiber emitters (nanorods) (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly.

Xu '444 teaches a conductive layer on top of the substrate (see column 6, lines 11-29, in particular lines 17-19). However, Xu does not teach that the layer is an epitaxial layer. Linthicum '198 discloses a microelectronic device having an epitaxially grown layer of 3C-silicon carbide on a converted (111) silicon layer. A layer of 2H-gallium nitride, which is dielectric, is then grown on the epitaxially grown layer of 3C-silicon carbide (see abstract lines 1-6). It would have been obvious to one of ordinary skill in the art at the time of this invention to use an epitaxial layer (as in Linthicum) on the substrate of Xu in order to take advantage of the reduced defects produced by epitaxial growth (see Linthicum column 1, lines 54-60). The conductive epitaxial buffer layer is expected to remain

As to claim 44, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); Xu discloses a catalyst metal film (since the catalyst is metal, it will serve as a conductive platform) on top of the substrate; with carbon fiber emitters (nanorods) on the metal (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly.

With regard to claims 35 and 48, the substrate of Xu can be an inorganic monocrystalline substance (see column 6, lines 33-35). Specifically, a silicon wafer can be used (see column 20, lines 12-14).

As to claim 42, Xu '444 discloses carbon fiber emitters having diameters of 20-100 nm (see column 19 lines 65-67).

As to claim 43, Xu discloses carburized metal (referred to as carbon fiber emitters) (see column 9, lines 25-32). Xu teaches a silicon carbide (see column 9, lines 30-31). Although Xu does not disclose where the carburized metal is from, it would have been obvious to use any of the metal oxides claimed in the present invention to provide the carburized metals.

As to claim 45, Xu '444 discloses a structure on top of the substrate, which can be a cone (see column 14, lines 22-32).

As to claim 46, Xu '444 teaches that the catalyst (the conductive layer) can be a transition metal, including molybdenum, platinum, palladium and niobium (see column 9, lines 26-39).

As to claim 47, Xu '444 discloses that the fiber emitter (nanorod) can be a carbide (see column 9, lines 25-32).

As to claims 50 and 51, Xu '444 discloses that the substrate can be a polycrystalline material or a glassy amorphous material (see column 6, lines 34-37)

As to claims 36, 39 and 49, Xu '444 teaches that any of the monocrystalline substances would work as the substrate (see column 6, lines 34-37). Therefore, it would have been obvious to one of ordinary skill in the art to select any of the monocrystalline substances for the substrate.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum as applied to claim 30 above, and further in view of USP 5,157,304 to Kane.

Xu '444 does not disclose that its field emission device can be used in imaging systems. Kane '304 does teach that field emission devices can be used in imaging systems (see column 1, lines 12-24). It would have been obvious to one of ordinary skill at the time of this invention to use the field emission device in an imaging system as suggested by Kane '304.

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum as applied to claim 30 above, and further in view of USP 6,054,801 to Hunt.

Xu '444 does not disclose that its field emission device can be used in a lighting system. Hunt '801 does teach that field emission devices can be used in lighting systems (see column 1, lines 36-45). It would have been obvious to one of ordinary skill at the time of this invention to use the field emission device in a lighting system as suggested by Hunt '801.

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum as applied to claim 30 above, and further in view of USP 6,465,132 to Jin taken with USP 6,911,767 to Takai.

Xu '444 discloses that the fiber emitter (nanorod) can be a carbide (see column 9, lines 25-32). Xu does not disclose all of the limitations of the claim. However, Jin '132 does disclose that the nanowire of its invention can be a nitride (see abstract for the discussion regarding using the nanowires in a field emission device, see also column 10, lines 32-56, which discloses what materials can be used to make the nanowires). Takai '767 discloses using silicides in field emission devices (see column 12, lines 66-67). It would have been obvious to use any of these other materials for the nanorods in the present filed emission device because the references teach that the other materials are effective in field emitter devices.

Claim 37 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum as applied to claims 30 and 44 above, and further in view of USP 6,376,007 to Rowell.

Xu '444 does not disclose the material used for the dielectric layer. Rowell '007 discloses that its dielectric material can be silicon dioxide or silicon nitride. It would have been obvious to use silicon dioxide or silicon nitride as the dielectric layer in the Xu reference because Rowell '007 teaches that these materials are dielectric.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 6,255,198 to Linthicum as applied to claim 38 above, and further in view of USP 6,586,093 to Laude.

As to claim 41, Xu does not disclose the use of nanoribbons in a field emission device. However, Laude '093 discloses different nanostructures (including nanoribbons, see column 1, lines 7-11) that can be used in field emission devices (see column 4, lines 20-22).

Claims 54-55, and 69-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 5,406,123 to Narayan.

As to claim 54, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); and carbon fiber emitters (nanorods) (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly. However, Xu does not teach a polycrystalline diffusion barrier affixed to the top of the side of the substrate. Narayan '123 teaches that titanium nitride films and coatings having polycrystalline structure have applications such as diffusion barriers in integrated circuit devices. As such, it would have been obvious to one of ordinary skill in the art at the time of this invention to add a polycrystalline diffusion barrier to the top of the substrate in Xu in order to prevent diffusion or to retard the inter-diffusion of the two superposed metals.

As to claim 55, Xu '444 discloses a field emission device comprising a substrate (see abstract and column 5, lines 24-30, see also figure 1) that can be an inorganic monocrystalline substance (see column 6, lines 33-35). Specifically, a silicon wafer can be used (see column 20, lines 12-14). As can be seen in Figure 1, there are several nanostructures extending from the substrate. Xu discloses that these nanostructures are carburized metal (referred to as carbon fiber emitters) (see column 9, lines 25-32). However, Xu does not teach a polycrystalline diffusion barrier affixed to the top of the side of the substrate. Narayan '123 teaches that titanium nitride films and coatings having polycrystalline structure have applications such as diffusion barriers in integrated circuit devices. As such, it would have been obvious to one of ordinary skill in the art at the time of this invention to add a polycrystalline diffusion barrier to the top of the substrate in Xu in order to prevent diffusion or to retard the inter-diffusion of the two superposed metals.

Claims 30, 35, 36, 38-40, 42-51, and 56-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman.

As to claims 30, 38, and 40, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); and carbon fiber emitters (nanorods) (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly. Xu '444 teaches a conductive resistor layer on top of the substrate (see column 6, lines 11-29). However, Xu does not teach that the resistor layer is a conductive epitaxial layer. Paranthaman discloses a epitaxial article having a substrate and a conductive epitaxial buffer layer and an active layer (see paragraph 0035). It would have been obvious to one of ordinary skill in the art at the time of this invention to use a conductive epitaxial buffer layer (as in Paránthaman on the substrate of Xu because Paranthaman teaches that the use of epitaxial layers permit the formation of improved devices (see Paranthaman paragraph 0004). Further, the conductive epitaxial layer would serve the same function as the layer of Xu, which desires a conductive layer in order to ensure that lost electrons are replaced (see Xu, column 6, lines 11-13). The conductive epitaxial layer is expected to remain.

As to claim 44, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); Xu discloses a catalyst metal film (since the catalyst is metal, it will serve as a conductive platform) on top of the substrate; with carbon fiber emitters (nanorods) on the metal (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly.

With regard to claims 35 and 48, the substrate of Xu can be an inorganic monocrystalline substance (see column 6, lines 33-35). Specifically, a silicon wafer can be used (see column 20, lines 12-14).

As to claim 42, Xu '444 discloses carbon fiber emitters having diameters of 20-100 nm (see column 19 lines 65-67).

As to claim 43, Xu discloses carburized metal (referred to as carbon fiber emitters) (see column 9, lines 25-32). Xu teaches a silicon carbide (see column 9, lines 30-31). Although Xu does not disclose

where the carburized metal is from, it would have been obvious to use any of the metal oxides claimed in the present invention to provide the carburized metals.

As to claim 45, Xu '444 discloses a structure on top of the substrate, which can be a cone (see column 14, lines 22-32).

As to claim 46, Xu '444 teaches that the catalyst (the conductive layer) can be a transition metal, including molybdenum, platinum, palladium and niobium (see column 9, lines 26-39).

As to claim 47, Xu '444 discloses that the fiber emitter (nanorod) can be a carbide (see column 9, lines 25-32).

As to claims 50 and 51, Xu '444 discloses that the substrate can be a polycrystalline material or a glassy amorphous material (see column 6, lines 34-37)

As to claims 36, 39 and 49, Xu '444 teaches that any of the monocrystalline substances would work as the substrate (see column 6, lines 34-37). Therefore, it would have been obvious to one of ordinary skill in the art to select any of the monocrystalline substances for the substrate.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman as applied to claim 30 above, and further in view of USP 5,157,304 to Kane.

Xu '444 does not disclose that its field emission device can be used in imaging systems. Kane '304 does teach that field emission devices can be used in imaging systems (see column 1, lines 12-24). It would have been obvious to one of ordinary skill at the time of this invention to use the field emission device in an imaging system as suggested by Kane '304.

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman as applied to claim 30 above, and further in view of USP 6,054,801 to Hunt.

Xu '444 does not disclose that its field emission device can be used in a lighting system. Hunt '801 does teach that field emission devices can be used in lighting systems (see column 1, lines 36-45). It would have been obvious to one of ordinary skill at the time of this invention to use the field emission device in a lighting system as suggested by Hunt '801.

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman as applied to claim 30 above, and further in view of USP 6,465,132 to Jin taken with USP 6,911,767 to Takai.

Xu '444 discloses that the fiber emitter (nanorod) can be a carbide (see column 9, lines 25-32). Xu does not disclose all of the limitations of the claim. However, Jin '132 does disclose that the nanowire of its invention can be a nitride (see abstract for the discussion regarding using the nanowires in a field emission device, see also column 10, lines 32-56, which discloses what materials can be used to make the nanowires). Takai '767 discloses using silicides in field emission devices (see column 12, lines 66-67). It would have been obvious to use any of these other materials for the nanorods in the present filed emission device because the references teach that the other materials are effective in field emitter devices.

Claim 37 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman as applied to claims 30 and 44 above, and further in view of USP 6,376,007 to Rowell.

Xu '444 does not disclose the material used for the dielectric layer. Rowell '007 discloses that its dielectric material can be silicon dioxide or silicon nitride. It would have been obvious to use silicon dioxide or silicon nitride as the dielectric layer in the Xu reference because Rowell '007 teaches that these materials are dielectric.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of US 2002/0198112 to Paranthaman as applied to claim 38 above, and further in view of USP 6,586,093 to Laude.

As to claim 41, Xu does not disclose the use of nanoribbons in a field emission device. However, Laude '093 discloses different nanostructures (including nanoribbons, see column 1, lines 7-11) that can be used in field emission devices (see column 4, lines 20-22).

Claims 54 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5,973,444 to Xu in view of USP 5,406,123 to Narayan.

As to claim 54, Xu '444 discloses a field emission device comprising a substrate; a dielectric layer; a conductive layer (in the Xu reference, the conductive layer is called a patterned gate metal film); and carbon fiber emitters (nanorods) (see abstract and column 5, lines 24-30, see also figure 1 and column 14, lines 40-43). As can be seen in Figure 1, Xu discloses a cavity extending downwardly. However, Xu does not teach a conductive polycrystalline diffusion barrier affixed to the top of the side of the substrate. Narayan '123 teaches that titanium nitride (titanium nitride is known to be conductive) films and coatings having polycrystalline structure have applications such as diffusion barriers in integrated circuit devices. As such, it would have been obvious to one of ordinary skill in the art at the time of this invention to add a polycrystalline diffusion barrier to the top of the substrate in Xu in order to prevent diffusion or to retard the inter-diffusion of the two superposed metals.

As to claim 55, Xu '444 discloses a field emission device comprising a substrate (see abstract and column 5, lines 24-30, see also figure 1) that can be an inorganic monocrystalline substance (see column 6, lines 33-35). Specifically, a silicon wafer can be used (see column 20, lines 12-14). As can be seen in Figure 1, there are several nanostructures extending from the substrate. Xu discloses that these nanostructures are carburized metal (referred to as carbon fiber emitters) (see column 9, lines 25-32). However, Xu does not teach a conductive polycrystalline diffusion barrier affixed to the top of the side of the substrate. Narayan '123 teaches that titanium nitride films (titanium nitride is known to be conductive) and coatings having polycrystalline structure have applications such as diffusion barriers in

integrated circuit devices. As such, it would have been obvious to one of ordinary skill in the art at the time of this invention to add a polycrystalline diffusion barrier to the top of the substrate in Xu in order to prevent diffusion or to retard the inter-diffusion of the two superposed metals.

Conclusion

Applicant's arguments filed 01/29/2007 have been fully considered but they are not persuasive. The rejections of the previous action have been modified to treat the newly added claims.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

All amendments made in response to this Office Action must be accompanied by a pinpoint citation to the Specification (i.e. page and paragraph or line number).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel C. McCracken whose telephone number is (571) 272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-

direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Daniel C. McCracken
Assistant Examiner
DCM

Stuart L. Hendrickson
Primary Examiner